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TITLE: SUBSTRATE TRANSFER SYSTEM

PUBN-DATE: June 30, 1998

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INT-CL (IPC): H01L021/68;B65G049/07 ;H01L021/02

ABSTRACT:

PROBLEM TO BE SOLVED: To obtain a substrate transfer system in which efficiency of substrate transfer processing is enhanced while preventing the substrate from being shifted.

SOLUTION: A drive control means C controls a drive means R based on the control conditions of transfer speed and transfer acceleration being set for respective chambers PC1, PC2, PC3 to move a substrate holding means T holding a substrate W thus transferring the substrate W with respect to a chamber. Consequently, the substrate W is prevented from being shifted by setting a transfer speed and a transfer acceleration causing no shift of the substrate W. Furthermore, the time required for transfer processing can be shortened by setting the transfer speed and the transfer acceleration within a range causing no shift of the substrate W.

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TITLE: High torque synchronous magnetic coupling

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ABSTRACT:

CHG DATE=19990905 STATUS=C>A synchronous magnetic coupling has permanent magnets on the driving and driven shafts and a cylindrical airgap between coaxial rotors. Each of the poles on the two rotors is formed from two permanent magnets which are positionned with opposing polarities parallel to the axis of rotation. The number of poles on the driving rotor may differ from the number of poles on the driven rotor and three permanent magnets with alternate polarities may be used to form each pole. The shape of each permanent magnet may be parallelepiped or cylindrical.

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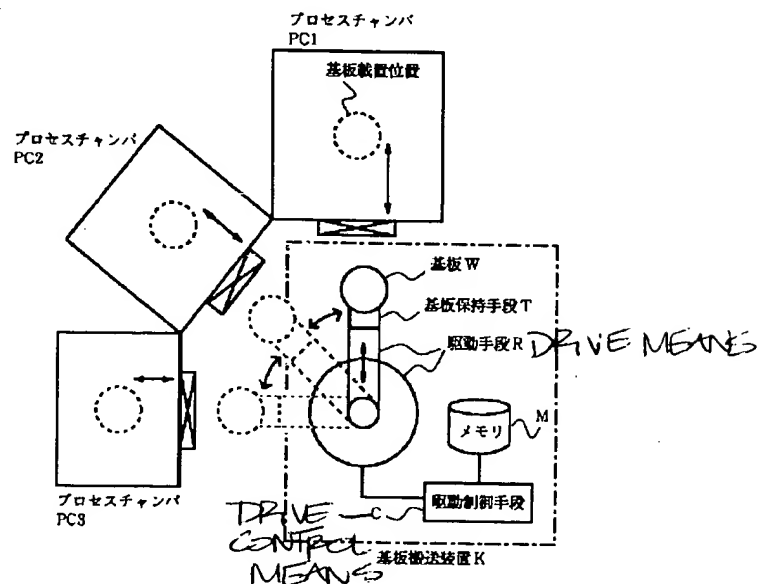
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(54)【発明の名称】 基板搬送装置

(57)【要約】

【課題】 搬送処理において基板のずれを防止するとともに基板搬送処理の処理効率を向上する。

【解決手段】 駆動制御手段Cが各チャンバPC1、PC2、PC3毎に設定された搬送速度及び搬送加速度の制御条件に基づいて駆動手段Rを制御し、駆動手段Rによって基板Wを保持した基板保持手段Tを移動させてチャンバに対する基板Wの搬送を行わせる。したがって、基板のずれが発生することのない搬送速度及び搬送加速度を設定することによって、基板のずれの発生を防止することができる。また、基板のずれが発生しない範囲内で、搬送速度及び搬送加速度を設定することによって、搬送処理にかかる時間を短縮することができる。



【特許請求の範囲】

【請求項1】 複数のチャンバに対して基板の搬送処理を行う基板搬送装置において、
基板を保持して搬送を行う基板保持手段と、
基板保持手段を移動させてチャンバに対する基板の搬送を行わせる駆動手段と、
各チャンバ毎に設定された搬送速度及び搬送加速度の少なくとも一方の制御条件に基づいて、各チャンバ毎に駆動手段による基板保持手段の移動を制御する駆動制御手段と、を備えたことを特徴とする基板搬送装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、複数のチャンバを備えた半導体製造装置において、複数のチャンバに対する基板の搬送処理を行う基板搬送装置に関する。

【0002】

【従来の技術】半導体製造装置には、半導体ウェーハやガラス基板等といった処理対象の基板に対して複数の所定の処理を施すために、複数のチャンバを備え、各チャンバ間の基板の搬送処理を基板搬送装置によって行わせるものがある。このような半導体製造装置を図3に示す当該装置の一部分を参照して説明する。この半導体製造装置は、基板に対して所定の処理を施すプロセスチャンバPC1～PC3と、チャンバ間の基板の搬送処理を行う基板搬送装置Jと、を備えている。

【0003】プロセスチャンバPC1～PC3は、互いに異なる処理を行うチャンバとなっており、チャンバの形状が異なっている。基板搬送装置Jは、基板を載置保持する基板保持手段Tと、回転及び伸縮動作を行うことによって基板保持手段Tを移動させる駆動手段Rと、を備え、各チャンバに対する基板の搬入処理及び搬出処理を予め設定された同一の搬送速度及び搬送加速度に基づいて行っている。

【0004】例えば、プロセスチャンバPC1へ基板を搬入する場合には、前記設定に基づいた回転及び伸長動作によって駆動手段Rが基板を載置保持した基板保持手段TをプロセスチャンバPC1内に移動させ、所定の基板載置位置に基板保持手段Tが保持する基板を載置させる。次いで、前記設定に基づいた収縮動作によって駆動手段Rが基板保持手段TをプロセスチャンバPC1外に移動させる。

【0005】一方、プロセスチャンバPC1から基板を搬出する場合には、前記設定に基づいた回転及び伸長動作によって駆動手段RがプロセスチャンバPC1内に移動させ、所定の基板載置位置の基板を基板保持手段Tに載置させる。次いで、前記設定に基づいた収縮動作によって駆動手段Rが基板を載置保持した基板保持手段TをプロセスチャンバPC1外に移動させる。そして、他のチャンバに対しても予め設定された前記同一の搬送速度及び搬送加速度に基づいて基板の搬送処理を行ってい

る。なお、駆動装置Rが複数の機構（軸）で構成されている場合には、上記した搬送速度及び搬送加速度として、各軸毎の速度及び加速度が設定されている場合がある。

【0006】なお、特開平7-307373号公報に記載された発明では、ウエハ（基板）の搬送処理において、ウエハが保持されているか否かによって、速度及び加速度を変えることによって、搬送処理の処理効率を向上させることが記載されている。

【0007】

【発明が解決しようとする課題】半導体製造装置では、基板の搬送処理に要する時間を短縮して処理効率を向上させることが望まれており、このために、上記した基板搬送装置では、搬送速度を速く、搬送加速度を大きくすることが行われている。

【0008】しかしながら、上記した従来の基板搬送装置においては、駆動装置が伸長する長さが長くなるほど、基板保持手段に与える振動が大きくなり、搬送速度が速く又は搬送加速度が大きくなるほど振動が基板保持手段の基板に与える影響が大きくなるといった傾向にあり、基板保持手段が基板を保持している際の搬送速度及び搬送加速度は、駆動装置による最も長い伸長動作を必要とするチャンバに対する搬送処理において、基板のずれ、基板の脱落等といった事態を防止できるものでなければならない、時間の短縮にも限度があった。

【0009】そこで、本発明は、従来の事情に鑑みなされたもので、搬送処理において基板のずれを防止するとともに基板搬送処理の処理効率をさらに向上することのできる基板搬送装置を提供することを目的としている。

【0010】

【課題を解決するための手段】上記した目的を達成するために本発明は、搬送対象のチャンバ毎に基板のずれが発生する搬送速度及び搬送加速度が異なる場合があることに着目してなされたもので、各チャンバ毎に搬送処理における搬送速度及び搬送加速度の少なくとも一方の制御条件を設定し、当該制御条件に基づいて、各チャンバに対する搬送処理を行う。

【0011】本発明に係る基板搬送装置は、複数のチャンバに対して基板の搬送処理を行う基板搬送装置において、基板を保持して搬送を行う基板保持手段と、基板保持手段を移動させてチャンバに対する基板の搬送を行わせる駆動手段と、各チャンバ毎に設定された搬送速度及び搬送加速度の少なくとも一方の制御条件に基づいて、各チャンバ毎に駆動手段による基板保持手段の移動を制御する駆動制御手段と、を備えたことを特徴とする。

【0012】上記した基板搬送装置では、駆動制御手段が各チャンバ毎に設定された搬送速度及び搬送加速度の少なくとも一方の制御条件に基づいて駆動手段による基板保持手段の移動を制御し、チャンバに対する基板の搬送を行わせる。したがって、各チャンバ毎に基板のずれ

が発生することのない搬送速度及び搬送加速度の少なくとも一方の制御条件を設定することによって、基板のずれの発生を防止することができる。また、各チャンバ毎に基板のずれが発生しない範囲内で、搬送速度を速く、搬送加速度を大きく設定することによって、搬送処理にかかる時間を短縮することができる。

【0013】

【発明の実施の形態】本発明の一実施例に係る基板搬送装置を備えた半導体製造装置の一部分を図1を参照して説明する。なお、従来例と同一部分には同一番号を付している。基板搬送装置Kは、基板を載置保持する基板保持手段Tと、基板保持手段Tを移動させる駆動手段Rと、駆動手段Rの動作を規定する速度及び加速度の制御条件を保持するメモリMと、メモリMの制御条件に基づいて駆動手段Rを制御する駆動制御手段Cと、を備えている。

【0014】駆動手段Rは、複数の軸を備えた構成となっており、各軸が供働することによって伸長、収縮、回転といった動作を行って基板保持手段Tを移動させる。メモリMは、例えば、図2に示すように駆動手段Rによる動作の状況に対応させた速度及び加速度の制御条件をテーブルとして保持しており、本実施例では、速度及び加速度の制御条件を駆動手段Rの各軸毎に分けて保持している。

【0015】例えば、駆動手段Rの加速度（減速度）を“速度1”として、駆動手段Rを通常移動させる際のイニシャル速度と、プロセスチャンバ内の異物を検出しながら基板を搬送するといった事象の第1調整速度とを“速度2”として、駆動手段Rの軸1～軸4による動作を行う或る事象の速度と、駆動手段Rの軸5及び軸6による動作を行う或る事象の第2調整速度とを“速度3”として、基板保持手段Tが基板を保持していない場合の速度を“速度4”として、プロセスチャンバPC1に対する動作において基板保持手段Tが基板を保持している際に基板のずれを生じさせることのない搬送速度を“速度5”として、プロセスチャンバPC2に対する動作において基板保持手段Tが基板を保持している際に基板のずれを生じさせることのない搬送速度を“速度6”として、プロセスチャンバPC2に対する動作において基板保持手段Tが基板を保持している際に基板のずれを生じさせることのない搬送速度を“速度7”として保持している。ここで、基板を保持していない場合の速度“速度4”としては、基板を保持している場合の速度“速度5”、“速度6”及び“速度7”よりも速いものを設定している。

【0016】なお、複数の事象であっても速度が同一の場合には、上記した“速度2”のように同一のエントリにまとめることによって、メモリMの記憶効率を向上させることができる。また、或る事象において動作する軸と、他の或る事象において動作する軸とが重ならない場

合には、上記した“速度3”のように同一のエントリにまとめることによってメモリMの記憶効率を向上することができる。

【0017】なお、図2に示すテーブルをディスプレイ装置等の表示装置（図示せず）に表示させておき、キーボード等の入力手段（図示せず）からオペレータがメモリMへ情報を設定できるようにすることもできる。

【0018】駆動制御手段Cは、駆動手段Rを動作させる状況に応じて、メモリMから当該状況に対応する速度及び加速度を取り出し、取り出した速度及び加速度に従って駆動手段Rの各軸を制御する。例えば、プロセスチャンバPC1に対して基板を搬入する場合においては、メモリMから“速度1”及び“速度5”を取り出し、当該取り出した“速度1”を搬送加速度とし、“速度5”を搬送速度として、駆動手段Rの各軸を制御する。

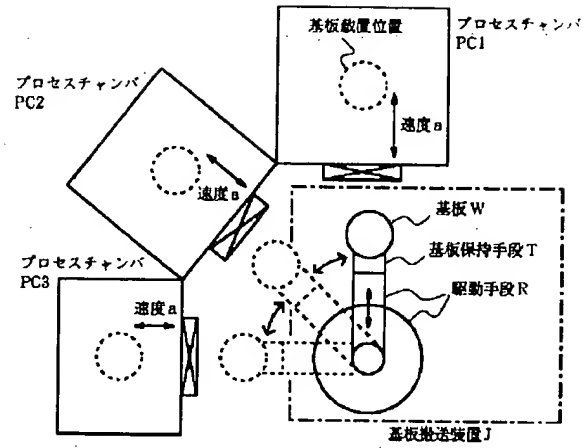
【0019】次に、上記した基板搬送装置Kの動作をプロセスチャンバPC1に載置されている基板をプロセスチャンバPC3に搬送する場合を例にとって説明する。まず、駆動制御手段CがメモリMから基板不保持速度“速度4”と、加速度“速度1”を取り出し、当該“速度4”及び“速度1”に従って、駆動手段Rを回転及び伸長させて基板を保持していない基板保持手段TをプロセスチャンバPC1内に移動させ、所定の基板載置位置の基板を基板保持手段Tに載置させる。次いで、駆動制御手段Cは、メモリMからプロセスチャンバPC1に対する基板の搬送速度“速度5”を取り出し、当該“速度5”及び“速度1”に従って、駆動手段Rを収縮させて、基板保持手段TをプロセスチャンバPC1外に移動させる。

【0020】次に、駆動制御手段CがメモリMからプロセスチャンバPC3に対する基板搬送速度“速度7”を取り出し、当該“速度7”及び“速度1”に従って、駆動手段Rを回転及び伸長させて基板保持手段TをプロセスチャンバPC3内に移動させ、所定の基板載置位置に基板保持手段Tが保持する基板を載置させる。次いで、駆動制御手段Cは、メモリMから基板不保持速度“速度4”を取り出し、当該“速度4”及び“速度1”に従って、駆動手段Rを収縮させて、基板保持手段TをプロセスチャンバPC3外に移動させる。

【0021】このように、各チャンバに対する駆動手段Rによる動作時に、基板保持手段Tが基板を保持している場合には、基板のずれを生じさせない各チャンバ毎の搬送速度に従って基板の搬送が行われるために、基板のずれが発生することを防止できる。また、各チャンバ毎の搬送速度を基板のずれが発生しない範囲で速くすればするほど、搬送処理時間を短縮することができる。また、基板を搬送していない場合には基板を保持している場合よりも速度を速くしたために、搬送処理の時間をさらに短縮することができる。

【0022】なお、例えば、高温処理を行うプロセスチ

【図3】



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the substrate transport device which performs conveyance processing of a substrate to two or more chambers in semiconductor fabrication machines and equipment equipped with two or more chambers.

[0002]

[Description of the Prior Art] In order to perform two or more predetermined processings to the substrate of processing objects, such as a semiconductor wafer and a glass substrate, semiconductor fabrication machines and equipment are equipped with two or more chambers, and there is a thing to which conveyance processing of the substrate between each chamber is made to perform by the substrate transport device in them. Such semiconductor fabrication machines and equipment are explained with reference to some equipments concerned shown in drawing 3. These semiconductor fabrication machines and equipment are equipped with the substrate transport device J which performs conveyance processing of the substrate between process the chambers PC1-PC3 which perform predetermined processing to a substrate.

[0003] The process chambers PC1-PC3 are the chambers which perform mutually different processing, and the configurations of a chamber differ. By performing the substrate maintenance means T, rotation, and flexible operation which carry out installation maintenance of the substrate, the substrate transport device J is equipped with the driving means R to which the substrate maintenance means T is moved, and is performing the carrying-in processing and taking-out processing of a substrate to each chamber based on the same bearer rate and conveyance acceleration which were set up beforehand.

[0004] For example, when carrying in a substrate to the process chamber PC 1, a substrate maintenance means T by which driving means R carried out installation maintenance of the substrate by the rotation and extension operation based on the aforementioned setup is moved into the process chamber PC 1, and the substrate which the substrate maintenance means T holds in a predetermined substrate installation position is made to lay. Subsequently, driving means R move the substrate maintenance means T out of the process chamber PC 1 by contraction operation based on the aforementioned setup.

[0005] On the other hand, when taking out a substrate from the process chamber PC 1, driving means R make it move into the process chamber PC 1, and make the substrate of a predetermined substrate installation position lay in the substrate maintenance means T by the rotation and extension operation based on the aforementioned setup. Subsequently, driving means R move the substrate maintenance means T which carried out installation maintenance of the substrate out of the process chamber PC 1 by contraction operation based on the aforementioned setup. and the above beforehand set up also to other chambers -- conveyance processing of a substrate is performed based on the same bearer rate and conveyance acceleration. In addition, when the driving gear R consists of two or more mechanisms (shaft), the speed and acceleration for every shaft may be set up as the above-mentioned bearer rate and above-mentioned conveyance acceleration.

[0006] In addition, in invention indicated by JP,7-307373,A, raising the processing efficiency of

conveyance processing is indicated by changing speed and acceleration by whether the wafer is held or not in conveyance processing of a wafer (substrate).

[0007]

[Problem(s) to be Solved by the Invention] With semiconductor fabrication machines and equipment, to shorten the time which conveyance processing of a substrate takes and to raise processing efficiency is desired, for this reason, by the above-mentioned substrate transport device, it is quick in a bearer rate and enlarging conveyance acceleration is performed.

[0008] However, it sets to the above-mentioned conventional substrate transport device. Vibration given to a substrate maintenance means becomes large, so that the length which a driving gear elongates becomes long. The inclination for the influence which it has on the substrate of a substrate maintenance means to become large has vibration, so that conveyance acceleration becomes [a bearer rate] quick greatly. In the conveyance processing to the chamber which needs the longest extension operation by the driving gear, the bearer rate and conveyance acceleration at the time of the substrate maintenance means holding the substrate must be what can prevent the situations, such as a gap of a substrate and defluxion of a substrate, and there was a limit also in shortening of time.

[0009] Then, this invention was made in view of the conventional situation, and it aims at offering the substrate transport device which can improve the processing efficiency of substrate conveyance processing further while it prevents a gap of a substrate in conveyance processing.

[0010]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention was made paying attention to the bearer rate and conveyance acceleration which a gap of a substrate generates for every chamber for conveyance differing from each other, sets up one [at least] control condition of the bearer rate in conveyance processing, and conveyance acceleration for every chamber, and performs conveyance processing to each chamber based on the control condition concerned.

[0011] In the substrate transport device to which the substrate transport device concerning this invention performs conveyance processing of a substrate to two or more chambers A substrate maintenance means to convey by holding a substrate, and the driving means which move a substrate maintenance means and make the substrate to a chamber convey, It is characterized by having the drive control means which control movement of the substrate maintenance means by driving means for every chamber based on one [at least] control condition of the bearer rate set up for every chamber, and conveyance acceleration.

[0012] Drive control means control movement of the substrate maintenance means by driving means based on one [at least] control condition of the bearer rate set up for every chamber, and conveyance acceleration, and make the substrate to a chamber convey in the above-mentioned substrate transport device. Therefore, generating of a gap of a substrate can be prevented by setting up one [at least] control condition of the bearer rate which a gap of a substrate does not generate for every chamber, and conveyance acceleration. Moreover, within limits which a gap of a substrate does not generate for every chamber, it is quick in a bearer rate and the time concerning conveyance processing can be shortened by setting up conveyance acceleration greatly.

[0013]

[Embodiments of the Invention] Some semiconductor fabrication machines and equipment equipped with the substrate transport device concerning one example of this invention are explained with reference to drawing 1. In addition, the same number is given to the same portion as the conventional example. The substrate transport device K is equipped with the drive control means C which control driving means R based on the control condition of the memory M holding the control condition of the speed which specifies operation of the driving means R and driving means R to which the substrate maintenance means T which carries out installation maintenance of the substrate, and the substrate maintenance means T are moved, and acceleration, and Memory M.

[0014] Driving means R have composition equipped with two or more shafts, when each shaft ****, perform operation, such as extension, contraction, and rotation, and move the substrate maintenance means T. Memory M holds as a table the control condition of the speed made to correspond to the

situation of operation by driving means R, and acceleration, as shown in drawing 2, and it divides and holds the control condition of speed and acceleration for every shaft of driving means R in this example.

[0015] For example, the initial speed at the time of usually moving driving means R by making acceleration (deceleration) of driving means R into "speed 1", The 1st adjustment speed of the event of conveying a substrate while detecting the foreign matter in a process chamber is made into "speed 2." Speed of a certain event which performs operation with the shaft 1 of driving means R - a shaft 4, and the 2nd adjustment speed of a certain event which performs operation with the shaft 5 and shaft 6 of driving means R are made into "speed 3." Speed when the substrate maintenance means T does not hold the substrate is made into "speed 4." The bearer rate which does not produce a gap of a substrate when the substrate maintenance means T holds the substrate in operation to the process chamber PC 1 is made into "speed 5." The bearer rate which does not produce a gap of a substrate when the substrate maintenance means T holds the substrate in operation to the process chamber PC 2 is made into "speed 6." When the substrate maintenance means T holds the substrate in operation to the process chamber PC 2, the bearer rate which does not produce a gap of a substrate is held as "a speed 7." the speed when not holding the substrate here -- the speed in the case of holding the substrate as "a speed 4" -- the thing quicker than "speed 5", "speed 6", and "speed 7" is set up

[0016] In addition, even if it is two or more events, when speed is the same, the storage efficiency of Memory M can be raised by collecting into the same entry like the above-mentioned "speed 2." Moreover, when the shaft which operates in a certain event, and the shaft which operates in other events of a certain do not lap, the storage efficiency of Memory M can be improved by collecting into the same entry like the above-mentioned "speed 3."

[0017] In addition, the table shown in drawing 2 is displayed on display (not shown), such as a display unit, and an operator can make it possible to set information to Memory M from input meanses (not shown), such as a keyboard.

[0018] According to the situation of operating driving means R, from Memory M, the drive control means C take out the speed and acceleration corresponding to the situation concerned, and control each shaft of driving means R according to the speed and acceleration which were taken out. For example, when carrying in a substrate to the process chamber PC 1, "speed 1" and "speed 5" are taken out from Memory M, the taken-out "speed 1" concerned is made into conveyance acceleration, and each shaft of driving means R is controlled by making "speed 5" into a bearer rate.

[0019] Next, the substrate currently laid in the process chamber PC 1 in operation of the above-mentioned substrate transport device K is explained taking the case of the case where it conveys to the process chamber PC 3. first, the drive control means C -- substrate a non-held speed from Memory M -- "speed 4" and acceleration -- "speed 1" is taken out, "speed 4" and "speed 1" concerned are followed, a substrate maintenance means T by which rotate and expand driving means R and the substrate is not held is moved into the process chamber PC 1, and the substrate of a predetermined substrate installation position is made to lay in the substrate maintenance means T subsequently, the bearer rate [as opposed to the process chamber PC 1 from Memory M in the drive control means C] of a substrate -- "speed 5" is taken out, driving means R are shrunk according to "speed 5" and "speed 1" concerned, and the substrate maintenance means T is moved out of the process chamber PC 1

[0020] next, a substrate bearer rate [as opposed to the process chamber PC 3 from Memory M in the drive control means C] -- "speed 7" is taken out, "speed 7" and "speed 1" concerned are followed, driving means R are rotated and expanded, the substrate maintenance means T is moved into the process chamber PC 3, and the substrate which the substrate maintenance means T holds is made to lay in a predetermined substrate installation position Subsequently, the drive control means C take out substrate non-held speed" speed 4" from Memory M, shrink driving means R according to "speed 4" and "speed 1" concerned, and move the substrate maintenance means T out of the process chamber PC 3.

[0021] Thus, since conveyance of a substrate is performed according to the bearer rate for every [which does not produce a gap of a substrate] chamber at the time of operation by the driving means R for each chamber when the substrate maintenance means T holds the substrate, it can prevent that a gap of a

substrate occurs. Moreover, the more it makes it quick in the range in which a gap of a substrate does not generate the bearer rate for every chamber, the more the conveyance processing time can be shortened. Moreover, when the substrate is not being conveyed, the time of conveyance processing can be shortened further to write speed quickly rather than the case where the substrate is held.

[0022] In addition, since the time of conveyance processing can be shortened when performing conveyance processing for example, to the process chamber which performs high temperature processing, the heating value taken from the chamber concerned during conveyance processing can be stopped, and the temperature control to the chamber concerned can be made easy.

[0023] In addition, in the above-mentioned example, although conveyance acceleration was made the same also in the conveyance processing to which chamber, if conveyance acceleration is set up for every chamber, while preventing a gap of the substrate in the conveyance processing to each chamber more effectively, the time of conveyance processing can be shortened. Moreover, since it can be made larger than the conveyance acceleration in the case of holding the substrate, the acceleration when not holding the substrate can shorten the time of conveyance processing more, if the acceleration when not holding the substrate is set up more greatly than the case where the substrate is held.

[0024] In addition, although the conveyance processing time was more effectively shortened in the above-mentioned example by making speed when not holding the substrate quicker than the bearer rate in the case of holding the substrate, it is not concerned with whether the substrate is held or not, but when it is set up for every chamber, having used speed as the same, the time of conveyance processing can be shortened.

[0025] In addition, what is necessary is to set up the control condition of only conveyance acceleration for every chamber, to be made to control based on the control condition concerned, and just to control in short based on one [at least] control condition of the bearer rate set up for every chamber, and conveyance acceleration, although it was made to control driving means by the above-mentioned example based on the control condition of both the bearer rate set up for every chamber, and conveyance acceleration.

[0026]

[Effect of the Invention] As explained above, in order to set up one [at least] control condition of a bearer rate and conveyance acceleration for every chamber and to convey a substrate based on the control condition concerned, while being able to prevent the situation where a gap of a substrate occurs, in the conveyance processing to each chamber, the time which conveyance processing takes can be shortened by the substrate transport device concerning this invention.

[Translation done.]